Virtual mouse with Color Detection Using Computer Vision

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Abstract-- **One of the important challenges in Human Computer Interactions is to develop more perceptive and more natural interfaces. User can not interact with a computer system without using keyboard and mouse. But because of various disabilities that affect many people to use keyboard and mouse with computers. We present in this paper a virtual mouse designed by us with color detection technique using web camera which can be used to interact with the computer in a more user friendly manner. This is an alternative approach for the traditional input devices.**

Keywords- **Hand gesture, Human Computer Interaction, Color Detection, Web camera**

I. INTRODUCTION

In this era of computer, every individual performs most of their day-to-day tasks using computers. The input devices like keyboard and mouse are mostly used by them while operating computers. But because of various disabilities that affects many people to continuous work with computers. Especially the disability with fingers is major problem to work with computer. Because of that disability the person can not operate keyboard and mouse. Instead of using those traditional input devices hands can be used directly as an input device which is an innovative method of Human Computer Interaction using Virtual Environment (VE).

In this paper we designed mechanism for virtual mouse using computer vision which can be used to interact with the computer in a more user friendly manner using Java and MATLAB. This is an alternative approach for the traditional static input devices like keyboard and mouse.

II. RELATED WORK

Many researchers are doing their research in the human computer interaction virtual environment. Abhik Banerjee et al [1] have developed an object tracking based virtual mouse application using a webcam. The system has been implemented in MATLAB environment using MATLAB Image Processing Toolbox. Kinjal N. Shah et al [2] have established the mechanism to interact with computer system using computer vision. This interaction is better than normal static keyboard and mouse. They have represented most of innovative mechanisms of the finger tracking used to interact with a computer system using computer vision. Erdem et al [3] have described a computer vision based mouse, which can control and command the cursor e.g. click a mouse button using a camera. A click of the mouse button was implemented by defining a screen such that a click occurred when a user's hand passed over the region. Chu-Feng Lien [4] had used only finger tips which were used to control both the movement of mouse cursor and mouse click. In his approach the user need to hold the mouse cursor on the desired spot for a specific period of time for clicking operation which is based on image density. Hojoon Park [5] had shown how to build this mouse control system. In his paper he had used a camera and computer vision technology, such as image segmentation and gesture recognition, to control mouse tasks (left and right clicking, double-clicking, and scrolling) and he had shown how it can perform everything current mouse devices can. Kamran Niyazi et al[6] have developed method by using camera and computer vision technology such as image segmentation and gesture recognition, to control mouse tasks and have shown how it can perform everything as current mouse devices can. Y. Sato et al[7] have proposed method that is shown to be effective even in such a challenging situation and tracking method through demonstration using augmented desk interface. Paul Robertson et al [8] have described a vision-based virtual mouse interface in which they utilized a robotic head, visual tracking of the users head and hand positions and recognition of user hand signs to control an intelligent kiosk.

III. PROPOSED SYSTEM

In our work, we have tried to control mouse cursor movement, click events using a web camera which is mounted on the laptop. Here we used color detection techniques using Java for the mouse cursor movements and click events. The system collects the input from the colored taps which worn by the users.

A. Mouse Control Algorithm

Human-Computer Interaction through Real-Time Hand Tracking and Gesture Recognition is an appealing option for replacing primitive Human Computer Interaction (HCI) using a mouse or touchpad. We propose a system for using a webcam to track a users hand and recognize gestures to initiate specific interactions [1]. The contributions of our work will be to implement a system for hand tracking and simple gesture recognition in real time. The Basic algorithm is shown below.

Algorithm:
Step 1. Capture Real time video from Web camera
Step 2. Take snapshot from real time video
Step 3. Filter the color and Process
Step 4. Perform different mouse operation
              according to color detection

We designed simulating the left click and the right click events of the mouse by assigning different color pointers. After performing these processes on image, we check particular color to perform operation. If we can't find any color in them then we again take new image from real-time video and perform same operation again in a loop. These three colors can help user to achieve complete mouse functionality using hand and its gesture which is shown below.

Colour	Purpose
Red	Moving Mouse Cursor
Blue	Right Click Operation
Green	Left Click Operation

We use the algorithm which is given below to develop virtual mouse in Java:

Algorithm:

Step 1. Capture the real time video using Web-Camera.
Step 2. This image is getting frame by frame from real time video. Then we perform certain process on these images. Process is done the individual image frame.
Step 3: Filtering each image taken by real-time video and convert it into gray-scale image.
Step 4: Detect the colors (Red, Green and Blue) from image and extract it.
Step 5: After detecting the color from image, we convert it into binary image.
Step 6: Calculate centroid of an image region for purpose of tracking mouse pointer.
• If color is Red then we calculate the x-axis and y-axis of image region, calculate its centroid and move the mouse according to that value.
• If color is Blue then we perform a right click operation on give location of mouse pointer.
• If the color is Green then left click operation will be performed.

The following images show screen shots (images) which we developed. As it shows, a user is able to handle the complete mouse functionality using three color bands. Red color-band is used for move the mouse pointer by user with the help of java.awt.Robot object. Figure (3.1.1) shows when webcam detects the Red color tap in front of it, it triggers the mouse move functionality. Figure (3.1.2) shows Blue color-band triggers the right click operation. And Figure (3.1.3) shows Green color-band triggers the left click operation. With all these color bands user is able to handle the cursor without touching the mouse. When webcam is taking images from real time video, it performs various operations on it. First it extracts the color and filters the image. Then after that it converts it into binary image.

The centroid has been calculated according to the position of color tap on image and performs various activities.

B. Snapshot Algorithm

By using snapshot gesture, user is able to take snapshot from real time video. It requires two color bands, one is red and other is green. By calculating the distance or gap between them we set a specific threshold. When distance between two color band is less then specified value then it perform a process of taking snapshot.

Algorithm:

Step 1. Capturing the real time video using Web-Camera.
Step 2. Process the individual image frame.
Step 3. Convert each frame to a grey scale image.
Step 4. Color detection and extraction of the different colors (RGB) from gray scale image.
Step 5. Conversion of the detected image into a binary image.
Step 6. If color is red and green then calculate the distance between them.
             $x = xa - xb$
             $y = ya - yb$
Step 7. Check if $x + y <= 75$ then goto step 8 else goto step 1.
Step 8. Perform the process of taking snapshot and store it on harddisk.

Steps of taking snapshot:
In taking of snapshot from real-time video, first we capture the image using web-cam.
These images are taken for processing and stored on hard-disk of user computer. We perform certain process on these images. The processes are:
a) Filtering each image taken by real-time video and convert it into gray-scale image.
b) Detect the colors (red and green) from image and extract it.
c) After detecting the color from image, we convert it into binary image.

d) Calculate centroid of an image region for purpose of tracking mouse pointer.

After that processes we calculate the distance between these two colors taps e.g. Red and Green color. We calculate the distance by finding the difference of centroid between red and green color tap. If the calculated value is near the threshold value then we execute the code of taking snapshot and store that on hard-disk. If the given two colors (red and green) are not found in images then we again take snapshot from real-time video and perform same operation in loop. Figure (3.2.1) shows the picture of how to take snap shots.

User is able to take snapshot by using gesture as shown in above image. It first detects the red color and green color in front of web-cam. If the web-cam detects these two colors then it calculates its centroid. We set some threshold value and according to that when both the color band come in that region then it performs the snapshot operation and store it to the hard-disk with image name. Taking snapshot is totally based on detection of two colors (red and green) in front of web-cam and its actual distance between them. If the distance between this two color marker is less than decided threshold value then it takes snapshot and store that on user computer.

IV. CONCLUSION

In this era of computer, Human Computer Interaction (HCI) through computer vision is more convenient way to interact with the computer. Every individual performs most of their day-to-day tasks using traditional input devices like keyboard and mouse by them while operating computers. Users with the disability with fingers have major problem to work with computer. In this paper, virtual mouse application using color detection technique has been developed in Java using a webcam. This is very useful for disabled users. In future we are adding voice output for every operation. So together both i.e. virtual mouse with voice output will create the most robust application for disabled users.

V. ACKNOWLEDGMENT

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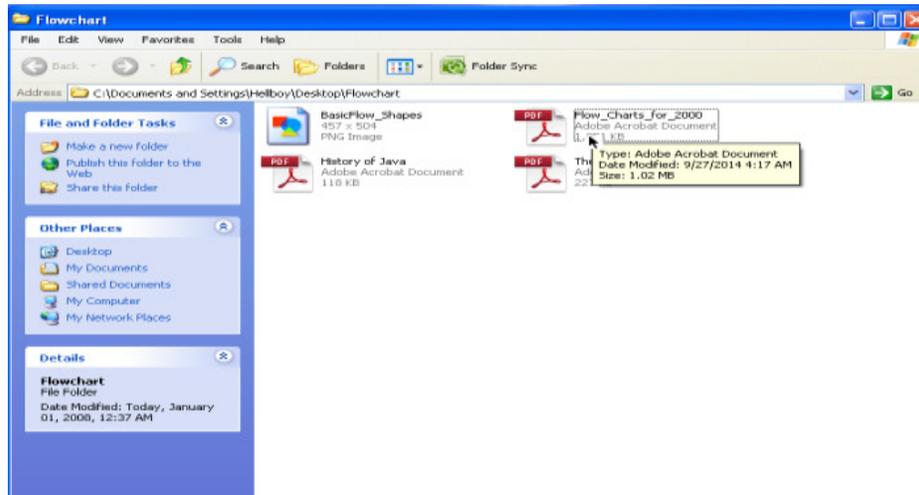
**Fig (3.1.1.): Moving mouse cursor using red color tap.**
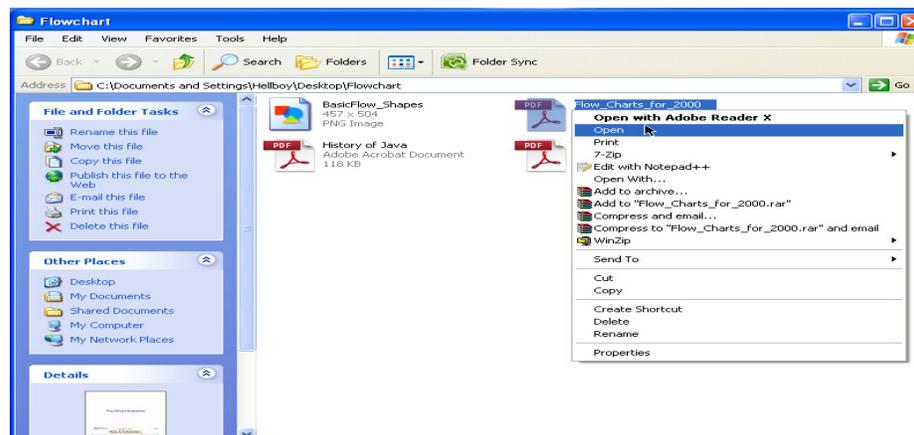
**Fig (3.1.2): Perform right click operation using blue color tap.**
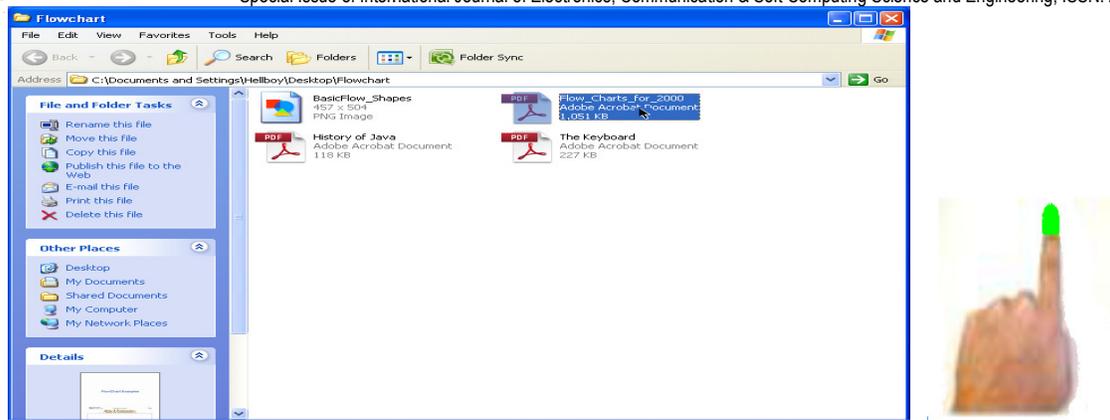
Fig (3.1.3): Perform left click operation using green color tap.
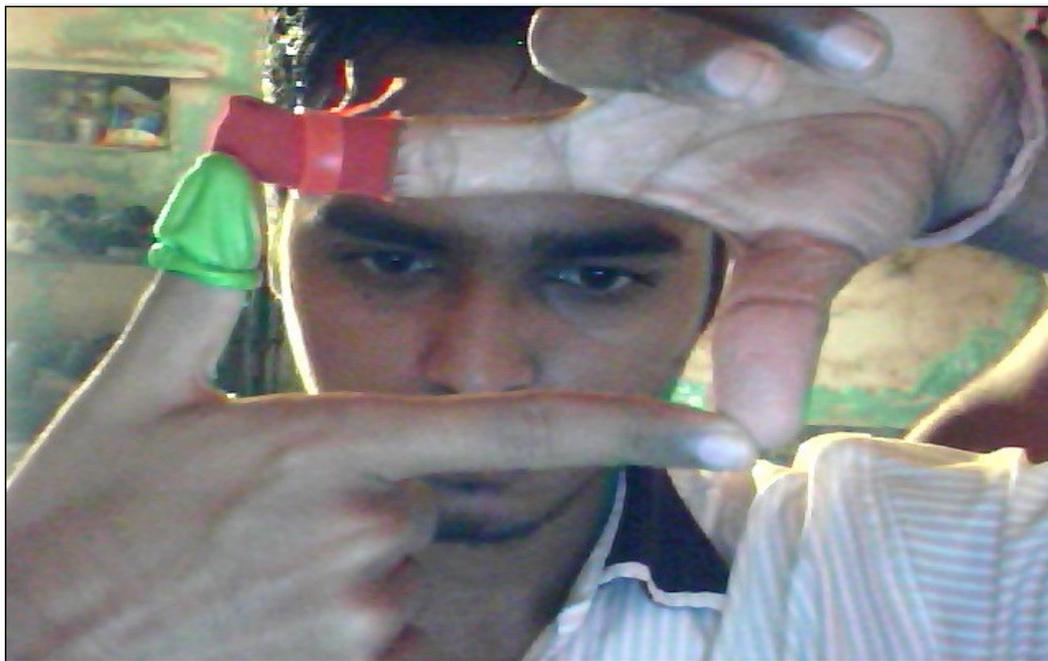
Fig (3.2.1): Perform snap shot operation